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А NEW SPECIES OF LAUBIERICONCHA (BIVALVIA: VESICOMYIDAE)
FROM DEEP WATERS OFF ARGENTINA

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ABSTRACT

A new species of bivalve belonging to the family Vesicomyidae, Laubiericoncha puer-todeseadoi, n. sp., is described. The material was collected during several cruises to the continental margin of Argentina on board of the R/V “Puerto Deseado”. The distribution of the genus Laubiericoncha is expanded to include the southwestern Atlantic Ocean. The description was done by using morphological characters ofthe shell and mantle cavity organs. Alltype ma-terial of congeneric species was examined and illustrated. Laubiericoncha puertodeseadoi, n. sp., is characterized by a compressed, subrectangular, elongated, inequilateral shell, with slightly prosogyrous umbo and a well-defined triangular pallial sinus, strong external ligament and ctenidia with two robust demibranchs, foot anteriorly projecting and fused siphons. This new species constitutes the first record ofthe genus Laubiericoncha living on the continental margin off Argentina.
Key words: Vesicomyidae, Argentina, new species, Laubiericoncha.

INTRODUCTION

The bivalve family Vesicomyidae, introduced
by Dall & Simpson (1901), constitutes one of
the six chemosymbiotic groups of bivalves that
live around hydrothermal vents, hydrocarbon
seeps and whale falls (Cosel & Olu, 2009; Kry-lova & Sahling, 2010; Taylor & Glover, 2010). Besides Vesicomyidae, species belonging to the families Lucinidae, Mytilidae, Nucinel-lidae, Solemyidae and Thyasiridae have been reported as being chemosymbiotic. Vesicomyid species were historically col-lected in waters from 100 m to 6,400 m depth hosting sulphide-oxiding bacteria in their gills (Sibuet & Olu, 1998; Cosel & Olu, 2008). The Vesicomyidae was mentioned by Hikida et al. (2003) as living in the Upper Cretaceous of Japan, but these authors did not illustrate its hinge structure, thus its vesicomyid position cannot be confirmed (Amano & Kiel, 2007). However, it has been widely recorded from middle to late Eocene of Washington to Recent by several authors (Otatume, 1942; Kanno et al., 1989; Squires & Goedert, 1991; Amano & Kanno, 2005; Krylova & Sahling, 2006; Kiel & Amano, 2010, among others).

The systematic position of Vesicomyidae is still far from resolved. It has been related to Veneroidea (Scarlato & Starobogatov, 1979), Glossoidea (Keen, 1969; Vokes, 1980; Boss, 1968, 1970, 1982; Bernard, 1983; Allen, 2001; Krylova & Janssen, 2006) and Arcticoidea (Okutani, 1966; Taylor et al., 1973; Slack-Smith, 1998). However, Taylor et al. (2007) left the family Vesicomyidae with an unresolved super-familial status. They concluded that although Arcticoidea and Glossoidea are usually men-tioned as superfamilies, the component, Arctici-dae, Trapezidae, Glossidae, Vesicomyidae and Kelliellidae may not be monophyletic. Those works that placed Vesicomyidae in Arcticoidea and suggested a position close to the Veneroi-dea (Giribet & Wheeler, 2002; Mikkelsen et al., 2006; Taylor et al., 2007). However, the close relationship between Arctica and the venerids Callista and Mercenaria, made Arcticoidea (vesicomyds and articids) non-monophyletic (Giribet & Wheeler, 2002).
Not only is the systematic status of Vesico-
myidae under discussion but also the internal
structure of clade is as well. The validity of
the family was studied by Allen (2001), who
revised the genera Kelliella Sars, 1870, and

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Vesicomya Dall, 1836. He suggested that both
type species are congeneric, making Vesico-
myidae a synonym of Kelliellidae (Glossoidea).
However, Krylova & Sahling (2010) rejected this
synonymy, keeping both families as valid until
new studies are performed. In recent years, several taxonomic studies, in which new taxa were introduced, placed the Vesicomyidae into Glossoidea (Krylova & Janssen, 2006; Cosel & Olu, 2008, 2009; Krylova & Cosel, 2011; Oliver et al., 2011, among others).
The suprageneric classification of Vesicomyi-dae was recently revised by Krylova & Sahling (2010). They recognized two subfamilies, Vesi-comyinae, with only one genus, Vesicomya, and Pliocardiinae which groups fifteen genera, including Laubiericoncha Cosel & Olu, 2008. In this study, Krylova & Sahling (2010) did not con-sider genera with such exclusively fossil species as Adulomya Kuroda, 1931, Hubertschenckia Takada, 1953, and Pleurophopsis Van Winkle, 1919. The genus Laubiericoncha was intro-duced for species with two demibranchs by Cosel & Olu (2008) when they described the new species L. myriamae from Barbados. In addition, they also included three other species, L. chuni (Thiele & Jaeckel, 1931), L. angulata (Dall, 1896) and L. suavis (Dall, 1913), in the genus. Currently, L. nanshaensis (Xu & Shen, 1991) also belongs to this genus (sensu Kry-lova & Sahling, 2010). Previously, new material collected by Krylova & Janssen (2006: 246, pl. 4 fig. 25) from Edison Seamount, southwest Pacific Ocean, was identified to family level and considered congeneric in Laubiericoncha by Cosel & Olu (2008). In addition, Krylova & Janssen (2006) considered as congeneric an undescribed species from Gakkel Ridge in the Arctic Ocean mentioned by Sirenko et al. (1995). Finally, Cosel & Olu (2008) and later Krylova & Sahling (2010) included both unnamed spe-cies into Laubiericoncha, but highlighting that additional specimens are required to confirm or reject this new taxonomic position.
The shell characters of Laubiericoncha, together with some diagnostic anatomical features (i.e., two demibranchs), allow us to recognize it from the other genera ofthe family. In this paper, we introduced a new species of Laubiericoncha from deep waters ofthe South Atlantic basin.

MATERIAL AND METHODS

The material herein described was collected during several cruises to the continental slope

of Argentina on board of the R/V “Puerto Deseado”. Most of the specimens were col-lected, with a modified Agassiz dredge, but in one station (24) with bottom trawl net also collected empty shells. One specimen with soft parts was fixed in 96% ethanol. All the other specimens were collected dead, but most of them with both valves still articulated. Critical point dry was used to study several soft parts, including the demibranchs, under the SEM (Philips XL30) at the MACN. Fresh cuts of the valves were coated and photographed at SEM. Type series measures are reported in the Table
1. Type material was deposited in the collec-tion of Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN-In) and Centro Nacional Patagónico (CNP-Inv).

SYSTEMATIC DESCRIPTION

Order Cardiida Férussac, 1822
Superfamily Glossoidea Gray, 1847
Family Vesicomyidae Dall & Simpson, 1901 Subfamily Pliocardiinae Woodring, 1925

Genus Laubiericoncha von Cosel & Olu, 2008.

Type Species: Laubiericoncha myriamae von Cosel & Olu, 2008, by original desig-nation.

TABLE 1. Type series measures with Laubieri-concha puertodeseadoi, n. sp.; F: length of fibrous ligament y, N: length of posterior lamellar ligament. Units in mm.

Specimen Length Height Width F N

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Distribution

Western Atlantic basin (this paper), Barba-dos. Eastern Atlantic: Gulf of Guinea. Eastern Pacific: Panama Bay, Baja California, Gakkel Ridge, Arctic.

Remarks

The morphological differences of Laubieri-concha with other large Vesicomyidae were pointed out by Cosel & Olu (2008) in their description of the genus. Species belonging to Laubiericoncha can be distinguished from other vesicomyid genera by the combination

of shell and anatomical characters. It differs from Callogonia Dall, 1889, by the presence of a larger shell with a different outline and hinge configuration characterized by a diverg-ing, thin but prominent cardinals (Cosel & Olu, 2008). Vesicomya Dall, 1886, and /sorropodon Sturany, 1896, have hinge morphology that is clearly different (Cosel & Salas, 2001; Cosel & Olu, 2008). Calyptogena, s.s., lacks a pal-lial sinus and has only one demibranch in
each gill, whereas Laubiericoncha has two
demibranchs and a triangular pallial sinus
Cosel & Olu, 2008). Archivesica Dall, 1908,
is the most similar to Laubiericoncha. It also
has two demibranchs, but the pallial sinus is

FIGS. 1-7. Laubiericoncha puertodeseadoi, n. sp. FIGS. 1-4: Laubiericoncha puertodeseadoi holotype, MACN-In 39803; FIG. 5: Paratype MACN-In 39804; FIGS. 6, 7: Paratype CNP-INV 1922. Scale bar: Figs. 1-5 = 5 cm, Figs. 6, 7 = 1 cm.

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shorter, broader and blunt (not acute), the
shell outline is subquadrate, the umbo is more
prominent and the ventral margin is straight.
Finally, species belonging to Laubiericoncha
can be easily distinguished from those vesico-
myids with a very elongate shell of the genera Abyssogena Krylova et al., 2010, Ectenagena Woodring, 1938, Pleurophopsis Van Winkle, 1919, and Adulomya Kuroda, 1931 (Cosel & Olu, 2008).

Laubiericoncha puertodeseadoi, n. Sp. (Figs. 1-28)

Types: Holotype, MACN-In 39803, articulated shell only. Twelve Paratypes from type lo-

cality: MACN-In 39804, eight articulated valves and a single right valve; CNP-INV 1921, one complete specimen with soft parts; CNP-INV 1922, a single right valve.

Type Locality: Station 24 of “Talud Continental I’ expedition on board of R/V “Puerto Deseado”, 3/°54.206'S, 54°2.616’W in 2,419.59 m depth collected on 14/August/2012 with bot-tom trawl.

Etymology: Dedicated to the crew of the Con-
sejo Nacional de Investigacion Cientifica
y Tecnica (CONICET)’s ship R/V “Puerto
Deseado” because of the effort and dedica-
tion to get these samples.

FIGS. 8-13. Laubiericoncha puertodeseadoi, n. sp. FIG. 8: Detail of left hinge; FIG. 9: Detail of right hinge, both from the specimen in fig. 5; FIGS. 10-13: Ultrastructure of the shell; FIGS. 10, 11: General aspect of three layers; FIG. 12: Detail of outer layer with irregular prisms; FIG. 13: Inner layer diffuse with irregular complex crossed lamellar structure. Scale bar: Fig. 10 = 1 тт, Fig. 11 = 500 um, Fig. 12 = 100 um, Fig. 13 = 200 um.

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FIGS. 14-17. Schematic drawings of the insides of valves of Laubiericoncha puertodeseadoi,
n. Sp. FIGS. 16, 17: Hinges of L. puertodeseadoi. Scale bar: 5 cm.

Additional Material Examined: MLP 13918:
2 right valves from St. 42 of Talud Conti-
nental exp., 37°59.110’S, 54°41.136’W in
877 m depth collected on 26/May/2013 with
modified Agassiz dredge; MLP 13919: 1
articulated specimen, four right and three left valves from St. 56 of Talud Continental exp., 37°54.840'S, 54°2.470’W 2,204 m to 37°55.405'$, 54°2.390’W, in 2,137 m, col-lected on 09/Sept/2013.

Description

Shell: compressed, moderately thick, large, up to 131 mm of shell length, approximately subrectangular, elongated, inequilateral with slightly prosogyrous umbo located appreciably closer to the anterior end, about 20-30 percent of total length of valves (Figs. 1-7); umbos very close but not touching (Fig. 3); dorsal margin curved, straight in younger specimens, ven-tral gently convex; anterior margin rounded; posterior margin enlarged, subrectangular to pointed profile; ornamentation comprising ir-regular, close arranged irregular growth lines; periostracum grey plumbic, yellowish glossy in young specimens, pellucid (Figs. 1, 5); Pallial line impressed, thick, visible all along; pallial sinus shallow and triangular (Figs. 2, 4, 7, 14—

15); anterior adductor scar teardrop shaped; posterior adductor scar subcircular, larger; anterior pedal retractor scar deeply impressed, somewhat hidden under the hinge plate, above very close but not touching anterior adductor scar; posterior pedal retractor scar united with posterior adductor scar; external ligament opist-hodetic, parivincular, strong, with fibrous layer occupying about 35% of shell length, placed on a thick nymphal plate (Fig. 3); subumbonal pit present and well distinct; hinge plate with a thin and prominent cardinal 1, anteriorly inclined and curved, dorsally surrounded by a curved cardinal tooth comprising the fused 3a and 3b in the right valve (Figs. 9, 17); left valve with, short, thick and fused 2a and 2b cardinal tooth, placed directly under the umbo, 2b de-scending vertically to the ventral margin of the hinge plate and 2a anteriorly inclined, a laminar cardinal tooth (4b) much longer but thinner and posteriorly inclined complete the left hinge (Figs. 8, 16); shell ultrastructure with an outer layer of reclined, very irregular fibrous prisms; middle layer of very diffuse crossed lamellar structure with barely distinguishable first order lamellae; inner layer very diffuse with irregular complex crossed lamellar structure. The inner and middle layer appear homogeneous at high magnifications (Figs. 10-13).

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General Anatomy: Ctenidia with two strong
demibranchs, the outer considerably shorter
than the inner in the dorsoventral axis, similar
in length occupying about half of shell length
Figs. 18-20), food groove clearly visible in
both demibranchs (Figs. 21, 22); foot anteriorly projecting, laterally flattened but well developed (Fig. 27); siphons fused, the incurrent slightly larger than excurrent; with very short tentacles along the apertural ring (Figs. 24—26), morphol-

ogy and size of tentacles looks equal in both siphons; heart elongated antero-posteriorly, with two auricles and one ventricle surrounding
the hindgut (Fig. 28).

Distribution

Only known from off Buenos Aires prov-
ince coast, southwestern Atlantic Ocean in
877-2,204 m depth.

FIGS. 18-28. Soft parts of Laubiericoncha puertodeseadoi, п. sp. FIG. 18: Left outer demibranch; FIG. 19: Left inner demibranch; FIG. 20: Right demibranch; FIG. 21: Food groove of outer demibranch; FIG. 22, 23: Food groove of inner demibranch; FIGS. 24-26: Fused siphons with short tentacles along the apertural ring; is: incurrent siphon, es: excurrent siphon); FIG. 27: Foot anteriorly directed; FIG. 28: Heart; a: auricle, у: ventricle. Scale bar: Figs. 18-20 = 2 mm, Figs. 21, 26, 27 = 200 um, Fig. 22 = 400 um, Fig. 23 = 100 um, Fig. 24 =4 mm, Figs. 25, 28 = 1 mm.

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Remarks

Combination of shell characters and general anatomy undoubtedly placed this new species into the genus Laubiericoncha. Shell outline of L. puertodeseadoi resembles L. chuni more than the type species, L. myriamae (Figs. 32-34, 29-31, respectively). It has a dorso-posterior area straight and enlarged that goes to the posterior end with a very pronounced angle very similar to L. chuni. The posterior end in L. puertodeseadoi and L. chuni is more

acute and lower, whereas in L. myriamae it is more rounded and placed in the horizontal mid-line. The rounded ventral margin of L. angulata (Figs. 40, 41) makes its shell outline more oval to ellipsoidal, whereas in L. puertodeseadoi is clearly straight, making it subrectangular. The oval to subcircular shell outline plus a
less elongate shell of L. suavis (Figs. 35-37),
with a less marked posterior end thus distinct
from the new species. The external ligament,
stronger and larger than that in L. myriamae,
L. chuni and L. suavis, easily distinguishing L.

FIGS. 29-41. Species included in the genus Laubiericoncha. FIGS. 29-31: L. myriamae, holotype MNHN 20550; FIGS. 32-34: L. chuni, Lectotype ZMB 77848a; FIGS. 35-37: L. suavis, holotype USNM 266881; FIGS. 38, 39: L. nanshaensis, holotype SSBII11—10 (no. 30934 in label); FIGS. 40, 41: L. angulata, holotype USNM 122933. Scale bar: Figs. 29-34 =4 cm; Figs. 35-41 = 2 cm.

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FIG. 42. Global occurrences of the genus Laubiericoncha, L. sp 1 correspond introduced by Sirenko et al., 1995 and L. sp 2 by Krylova & Janssen, 2006.

puertodeseadoi. The type material of L. angu-
lata lacks the ligament; however, the nymphal
plate is less developed posteriorly suggesting a
smaller ligament. Laubiericoncha nanshaensis
described from Nansha Islands, South China Sea, is smaller, with a posterior end more acute placed in the horizontal midline, and the pallial sinus is shallower (Figs. 38, 39). All species currently included in Laubiericoncha have the same hinge configuration and pallial sinus shape; however, there are some variation in tooth shape, orientation and size that allows distinguishing the valid species (Table 2). The intraspecific variation of L. puertodeseadoi was not evident. All collected specimens looks equal in hinge morphology, pallial sinus depth and shell outline. Nevertheless only ten articulate shells and eleven single valves were collected during the fieldwork, and additional specimens would be needed to confirm this observation. Despite the unique specimen collected with soft parts, the morphology of mantle cavity organs of L. puertodeseadoi is very close to L. myriamae and L. chuni. Siphons, ctenidia and foot morphology were similar to those ob-served in L. myriamae and L. chuni. However, we recognized slight differences, such as aless elongated ctenidia and a stronger foot in the new species. The morphology of soft parts of other members of the genus Laubiericoncha is, at the moment, unknown.

DISCUSSION

The family Vesicomyidae was previously registered in the southwestern Atlantic Ocean. Rios (1994, 2009) reported the presence of two species of vesicomyids, that is, Calyptogena troncosoi Rios, 2009, and Vesicomya albida (Dall, 1889), in the southern coast of Brazil. However the later species was considered into Kelliella (Rosenberg, 2014). Previously, Domaneschi & Lopes (1990) described Ca-lyptogena birmani off Parana state, also from the southern coast of Brazil. Within regional context, Laubiericoncha puertodeseadoi, n. sp., constitutes the first record of the fam-Ну Vesicomyidae, described off Buenos Aires province and the first record of the genus in the southwestern Atlantic Ocean. In recent years, the genus Laubiericoncha had been registered in several localities worldwide (Cosel & Olu, 2008; Krylova & Sahling, 2010). After three cruises to the deep canyons off Buenos Aires coast province (Mar del Plata submarine canyon), several specimens of Laubiericon-cha puertodeseadoi were collected between 870-2,200 m depth. The material was found together with gastropods о the families Natici-dae and Volutidae characteristic of soft bottoms with no signs of interaction among them. The taxonomic position of species grouped into the genus Laubiericoncha has been widely

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discussed (Cosel & Salas, 2001, Krylova & Jans-
sen, 2006). These authors noted differences
in hinge configuration, pallial sinus and shell
outline in a few described species then included
inthe genera Callogonia and Vesicomya. Later,
Cosel & Olu (2008) introduced the genus Lau-biericoncha to encompassed four species, the type species, L. myriamae, and L. angulata (Dall, 1896), L. chuni (Thiele & Jaeckel, 1931) and L. suavis (Dall, 1913). Finally, Krylova & Sahling (2010) considered L. nanshaensis (Xu & Shen, 1991) as а fifth species of the genus. This work confirmed Laubiericoncha puertodeseadoi, п. sp., asthe sixth described species ofthe genus, expanding its distribution to the southwestern Atlantic Ocean. However, there are two ad-ditional unnamed species that were tentatively placed in Laubiericoncha. They were registered by Sirenko et al. (1995) from Gakkel Ridge in the Arctic (L. sp 1; Fig. 42) and by Krylova & Janssen (2006) from Edison Seamount in the southwestern Pacific Ocean (L. sp 2; Fig. 42). The new species here described places the ge-nus Laubiericoncha in six geographical regions. It was registered in the Caribbean, Argentina, West African, Panamic, Indo Pacific and Arctic basins (Fig. 42). These records make Laubieri-concha a widely distributed genus of the family Vesicomyidae which share shell characters, like hinge configuration, pallial sinus form and shell outline, and soft parts, like two demibranchs and fused siphons.
Phylogenetic analysis ofthe family Vesicomyi-dae suggested a multiple trans-Pacific migra-tions between the western and eastern parts of the Pacific Ocean (Kojima et al., 2004). The cladistic relationships of Laubiericoncha and other vesicomyid genera were discussed by Decker et al. (2012). In their work, the species L. chuni and L. myriamae do not form a mono-phyletic group. They pointed out that taxonomy based on morphology of several genera, includ-ing Laubiericoncha, did not match with their molecular conclusions. This phylogenetic result agrees with those mentioned by Goffredi et al. (2003) who reported that vesicomyid genera are polyphyletic and need to be morphologically revised. The presence of two demibranchs in Laubiericoncha is considered as an ancestral character (Decker et al., 2012). In the Pliocardii-nae, this character is also shared by Archivesica species and Phreagena kilmeriand Ectenagena extenta forming a cluster supported by a 99% bootstrap value (Decker et al., 2012). Although Phreagena kilmeri and Phreagena soyoae were considered synonyms (Kojima et al., 2004;

Okutani et al., 2009), some authors consid-ered both species as valid (Krylova & Sahling, 2010; Coan & Valentich-Scott, 2012). Not only the presence of two demibranchs suggest a generic assignment, but also the sharing of hinge configuration, pallial sinus form and shell outline place the new species into Laubiericon-cha. In our analysis, we considered the genus Laubiericoncha as a natural taxon because morphological differences were not observed among valid species that would divide the genus into separate taxa. This discrepancy, between molecular taxa and morphological characters, should be retested. The genera mentioned by Decker et al. (2012) were represented in their analysis by only two species each one. Addi-tional material would be needed to confirm the polyphyletic status ofthe genus Laubiericoncha. Morphological characters of Atlantic species are closely related to Pacific species within the genus Laubiericoncha. These evolutionary relationships were mentioned by Peek et al. (2000), who suggested a circumpolar dispersal, with subsequent isolation leading to speciation. In addition, in recent years, different vesicomyid genera were revised and redefined (Cosel & Sa-las, 2001; Cosel & Olu, 2009; Krylova & Cosel, 2011; Krylova et al., 2010) and none of them questioned the affinities of these genera.

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